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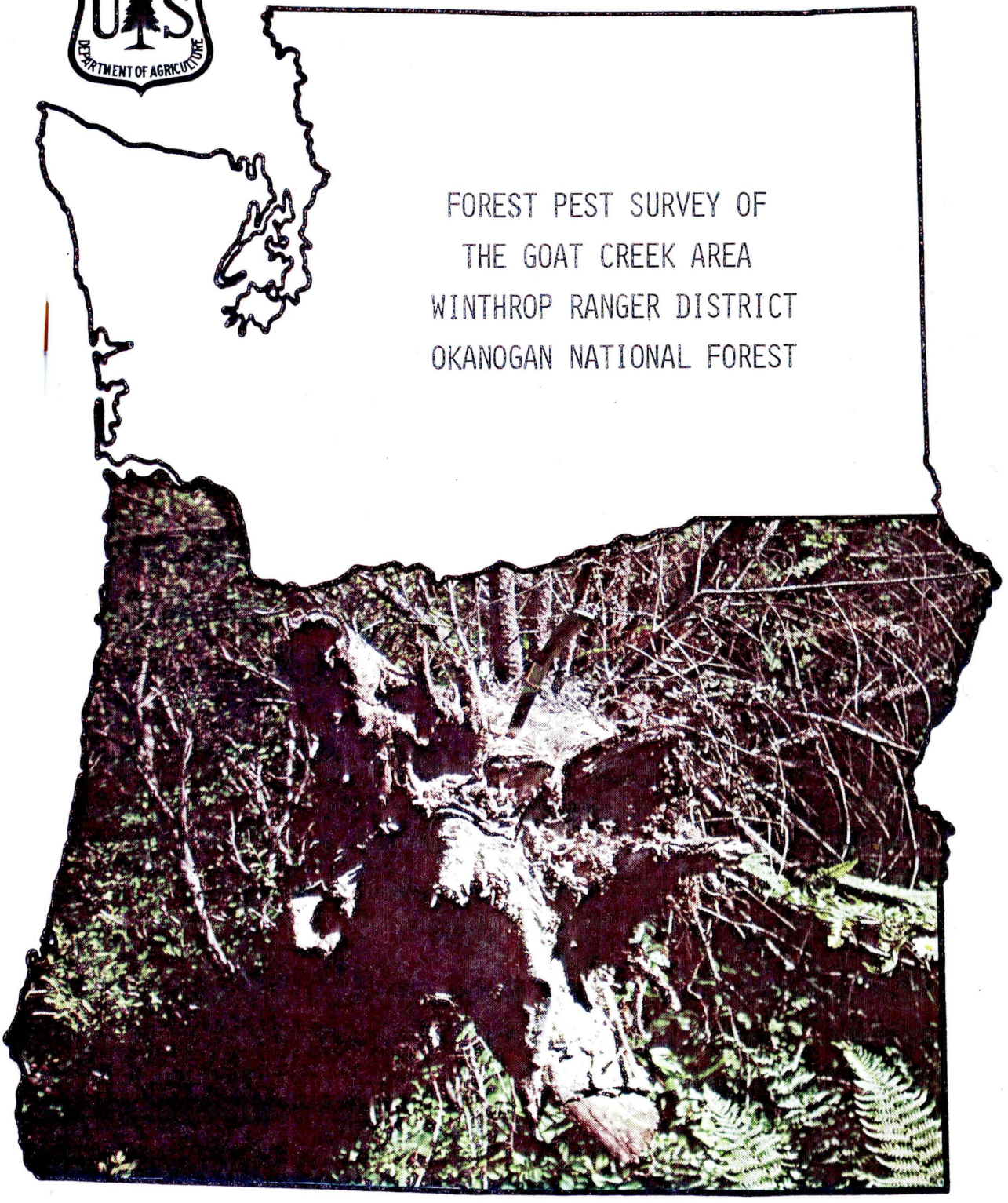
Forest Pest Management
Pacific Northwest Region

FOREST PEST SURVEY OF
THE GOAT CREEK AREA
WINTHROP RANGER DISTRICT
OKANOGAN NATIONAL FOREST



1983

FOREST PEST SURVEY OF THE GOAT CREEK AREA WINTHROP RANGER DISTRICT, OKANOGAN NATIONAL FOREST

by

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INTRODUCTION

In 1980, a Forest Pest Management crew surveyed for pest damage in a 24-acre stand in the Goat Creek Area (T. 36 N., R. 20 E., sec. 9) (Filip and others 1981). Much of the stand had extensive top-kill due to a previous epidemic of western spruce budworm (*Choristoneura occidentalis*). Dwarf mistletoe in lodgepole pine and Douglas-fir were found at moderate levels. No mortality caused by root diseases was detected in sample plots. During 1982, in response to a request by personnel of the Winthrop Ranger District, a Forest Pest Management crew surveyed for forest pests in a 1300-acre area northeast of the area surveyed in 1980. The objectives of this evaluation were to: (1) determine the extent and distribution of major forest pests, and (2) develop management strategies aimed at reducing pest-caused losses.

METHODS

The Goat Creek Area (Figure 1) was surveyed using a line intercept method modified from Bloomberg and others (1980). Transects were established at 10-chain (660') intervals. Lengths of transects and of intercepts of areas affected by each major pest were measured with a model M-25 hip-chain. We determined length of the intercepts (1) for individual affected trees by estimating the length of the transect that intersected the rooting zone (based on DBH) of an affected tree and (2) for large areas with insect or disease damage by noting the first and last occurrence of symptomatic trees along the transect. The percentage of the area affected by major pests was estimated as the proportion of the total transect that crossed affected areas.

We examined dead or symptomatic trees within two chains of the transect line for disease and insect infestation. Root diseases were identified by the presence of fruiting bodies and/or excavating and partially dissecting at least two major roots to a distance of 3 feet from the root collar and examining them for decay, stain, or fungal growth. Bark beetles were identified by removing bark from the trunk and observing gallery patterns. Crowns of trees were scanned for signs and symptoms of dwarf mistletoes, rusts, and insect damage. Trees infected with dwarf mistletoe were rated for severity using Hawksworth's 6-class system (Hawksworth 1977).

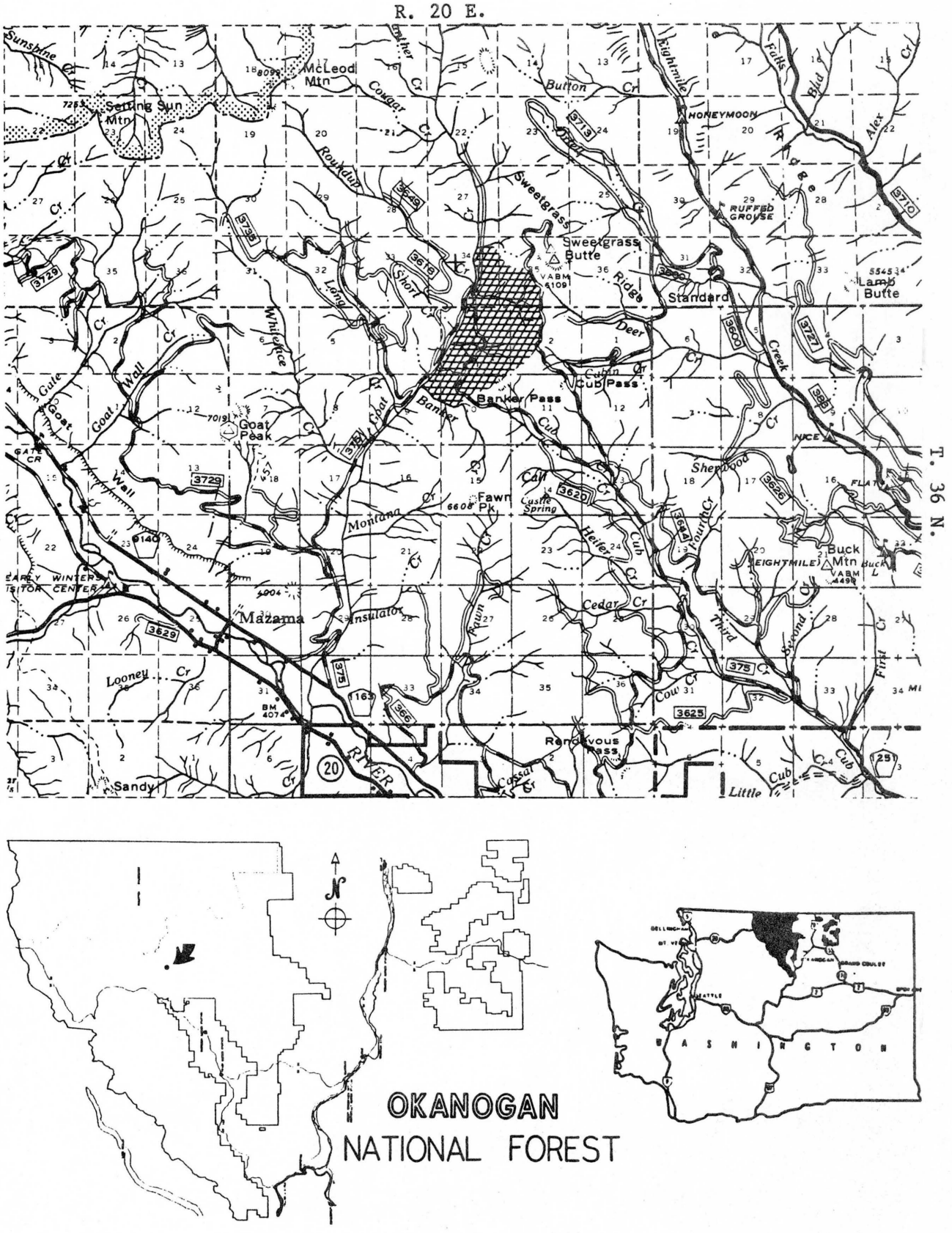

Figure 1. Map depicting the location of the Goat Creek Area (cross-hatching) on the Winthrop Ranger District.

Major topographic features and changes in forest type were also recorded. Maps were constructed showing the location of transects and areas affected by major pests.

RESULTS AND DISCUSSION

The Goat Creek Area (approx. 1300 acres) is stratified into two general timber types: the Douglas-fir type and the subalpine fir type.

Douglas-fir type--This type fits the description of the Douglas-fir/pinegrass (*Pseudotsuga menziesii/Calamagrostis rubescens*) association of Williams and Lillybridge (1982). It occurs on south and west exposures. Most of the area in this type has been partially cut one or more times and is sparsely stocked with mature Douglas-fir, with little natural regeneration. Pinegrass is the predominant ground cover. Dense young stands of mixed-conifers occur frequently in the southern one-third of the area in this type. The following species are present: lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), Douglas-fir, Engelmann spruce (*Picea engelmannii*) and, occasionally, western white pine (*Pinus monticola*) and ponderosa pine (*Pinus ponderosa*). Stand composition varies from pure lodgepole pine to pure Douglas-fir throughout these younger stands. Slopes are generally 30 percent or greater and the site is quite dry.

Subalpine fir type--The subalpine fir type is limited to the north-facing slopes. The subalpine fir/Cascade azalea (*Rhododendron albiflorum*) association best describes the eventual "climax" of this type (Williams and Lillybridge 1982). Most of this area is densely stocked with subalpine fir, Engelmann spruce, and Douglas-fir occurring with a varying age distribution. Openings are well stocked with regeneration, usually subalpine fir. Engelmann spruce is locally abundant in the stream bottoms.

The most frequently encountered diseases were laminated root rot, caused by the fungus *Phellinus weirii*, Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) and lodgepole pine dwarf mistletoe (*A. americanum*) (Table 1). Root and butt rot caused by *Phaeolus (Polyporus) schweinitzii* occurred in less than one percent of the area. We observed some scattered mortality (less than one percent of the area) of Douglas-fir and subalpine fir caused by the Douglas-fir beetle (*Dendroctonus pseudotsugae*) and fir engraver beetles (*Scolytus* spp.), respectively.

Table 1.--Percentage of the Goat Creek Area affected by laminated root rot and dwarf mistletoes, by forest type. Winthrop Ranger District, Okanogan National Forest.

Forest type	Total	Laminated root rot	Douglas-fir dwarf mistletoe	Lodgepole dwarf mistletoe
	Percentage of Area			
Douglas-fir	81	39	6	4
Subalpine fir	19	25	1	-
Total	100	36	5	3

Laminated root rot--*Phellinus weirii* was the most serious and widely-distributed pest in the Goat Creek Area, causing damage over 36 percent of the area (Figure 2). This represents an actual infected area of about 50-75 percent of the total area. Douglas-fir and subalpine fir were the most common hosts; Engelmann spruce was infected less frequently. The disease occurred in both the Douglas-fir and subalpine fir types.

Laminated root rot is an especially serious disease not only because of its significant effects on a currently infected stand, but because the causal fungus is persistent on the site. The fungus can survive up to 50 years in roots of large stumps, spreading via root contacts to susceptible trees that become established on the site. New infection centers develop and increase in size due to subsequent spread from tree to tree through root systems (Goheen and others 1982). If left untreated, laminated root rot poses a hazard to both existing and future stands in the Goat Creek Area.

Recommended treatment for laminated root rot is to cut all susceptible trees within infection centers and in a 50-foot buffer, and either (1) mechanically remove infected roots and stumps with heavy equipment and replant any species or (2) replant with tree species that are immune or have some degree of resistance to the disease and are adapted to the site. Mechanical removal of stumps is effective and allows the manager to replant with any tree species, but it is expensive, restricted to gentle terrain, and may contribute to soil damage (Goheen and others 1982). Because most of the terrain in the Goat Creek Area is moderately steep, tree species manipulation is the most reasonable treatment strategy.

Tree species occurring in the Goat Creek Area, by increasing degree of susceptibility to laminated root rot, are: immune-hardwoods; resistant-ponderosa pine; tolerant-western white pine and lodgepole pine; intermediately susceptible-Engelmann spruce; highly susceptible-Douglas-fir and subalpine fir. Although Hadfield and Johnson (1977) consider subalpine fir intermediately susceptible, our observations indicate that it may be as susceptible as Douglas-fir to laminated root rot in the Goat Creek Area. If only immune species are planted on an infected site and grown for a rotation of 50 years or more, *P. weirii*-infected material should decay to the point that it is no longer infective and susceptible tree species could be replanted. If resistant or tolerant species are planted, there should be a similar result, but a small amount of infection and retention of the pathogen may occur. Intermediately susceptible species may suffer little damage over a rotation, but many will be infected, and the disease will be maintained on the site. Planting highly susceptible species would prolong and intensify the problem.

Dwarf Mistletoes--Douglas-fir dwarf mistletoe was essentially confined to the southwestern quarter of the area (Figure 3). The average dwarf mistletoe rating was 4, ranging from 2 to 6. A few of the older Douglas-fir trees had apparently been killed as a result of dwarf mistletoe infection.

The distribution of lodgepole pine dwarf mistletoe is presented in Figure 4. Average dwarf mistletoe rating was 3, ranging from 2 to 4. The majority of infections occurred in the lower crowns, and no tree mortality from dwarf mistletoe infection was observed.

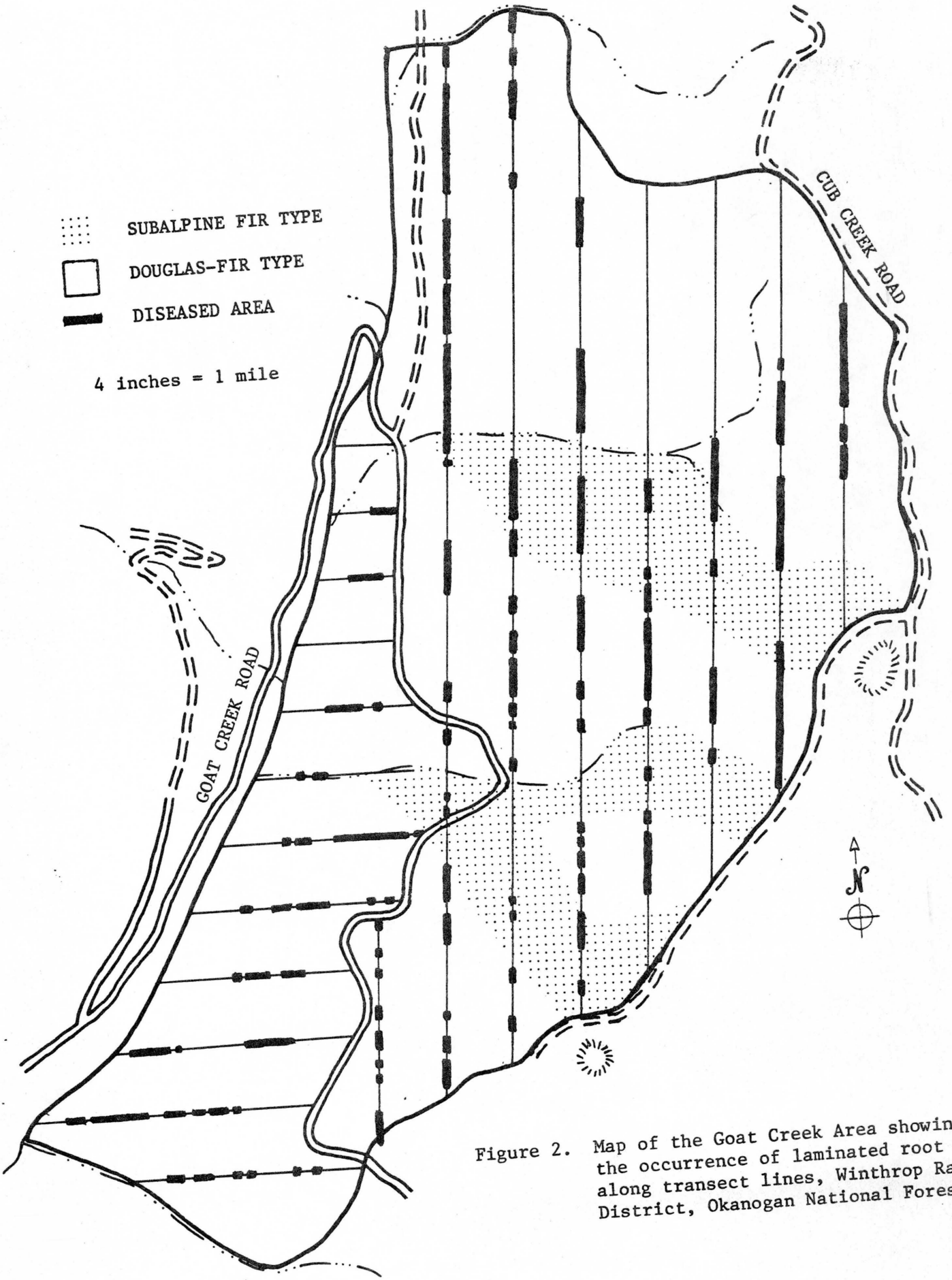

Figure 2. Map of the Goat Creek Area showing the occurrence of laminated root rot along transect lines, Winthrop Ranger District, Okanogan National Forest.

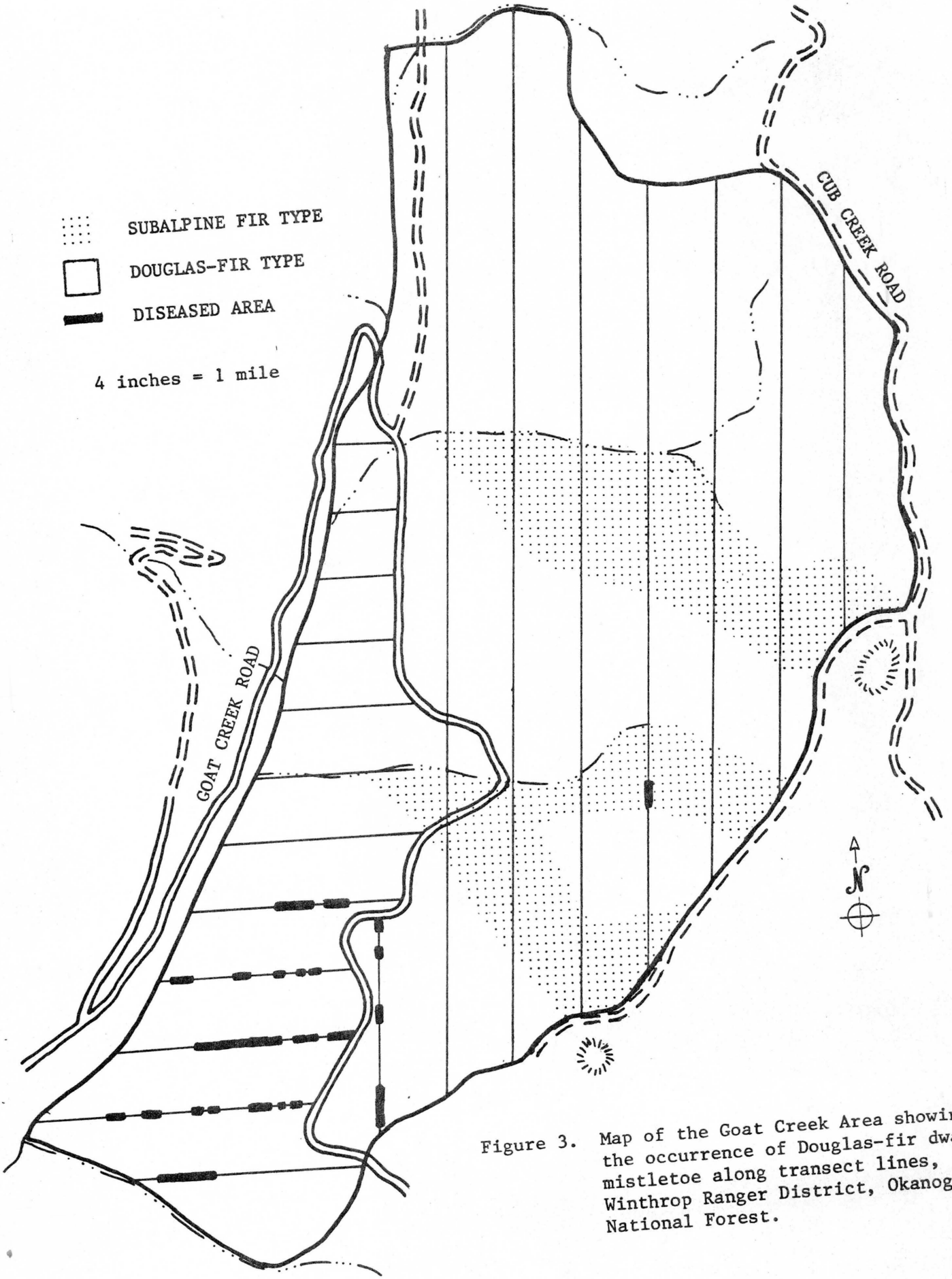

Figure 3. Map of the Goat Creek Area showing the occurrence of Douglas-fir dwarf mistletoe along transect lines, Winthrop Ranger District, Okanogan National Forest.

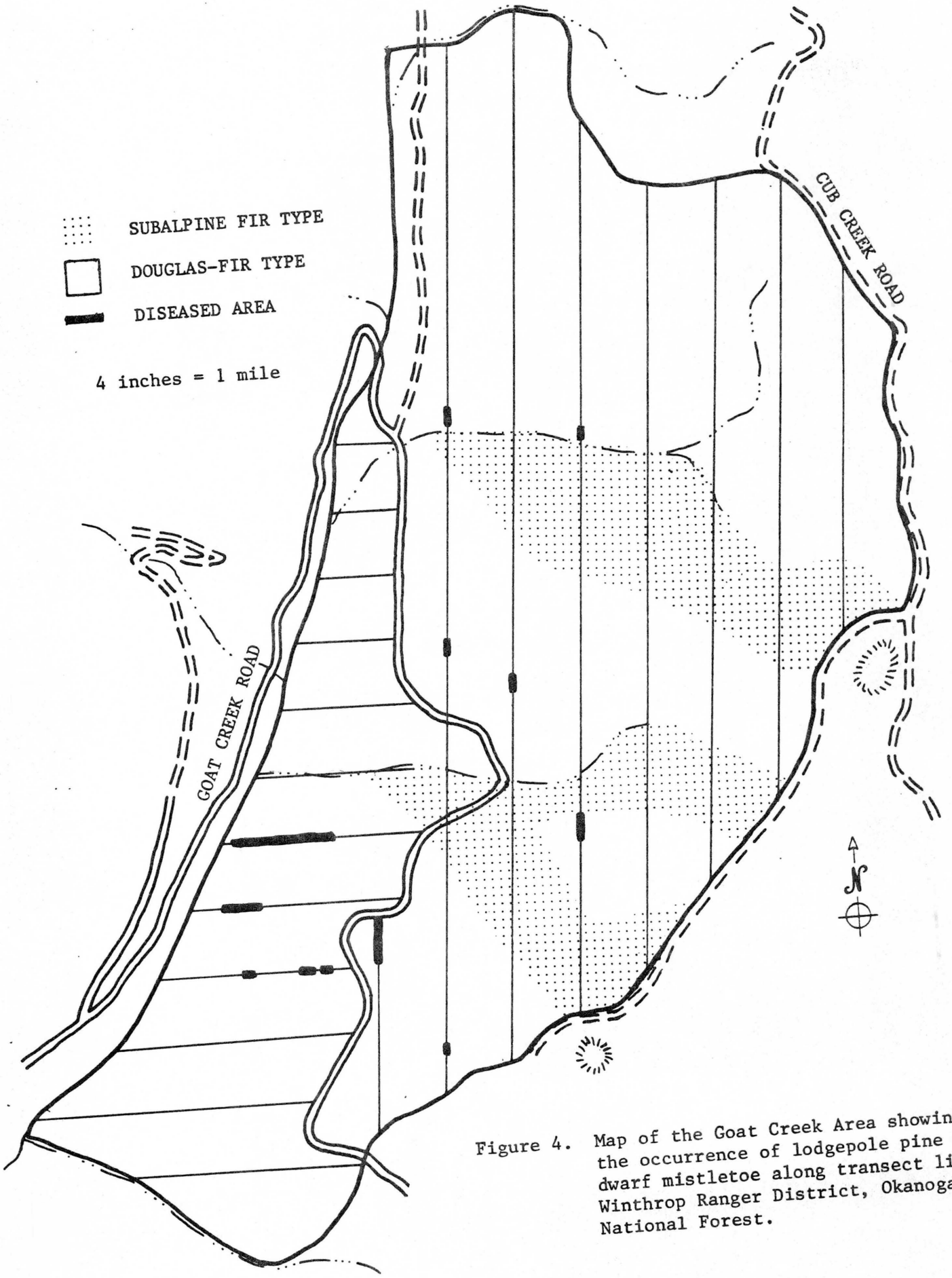

Figure 4. Map of the Goat Creek Area showing the occurrence of lodgepole pine dwarf mistletoe along transect lines, Winthrop Ranger District, Okanogan National Forest.

Dwarf mistletoes are parasitic plants that obtain food and water from their hosts. They can sufficiently drain the host in some cases to cause serious tree debilitation, but effects differ with degree and location of infection, host and mistletoe species, and host vigor. Dwarf mistletoes spread by seeds that are forcibly discharged from the mature female plant in the host tree to other trees below. Most dwarf mistletoes are quite host-specific and will successfully infect only one tree species (Goheen and others 1982).

Although very little mortality from dwarf mistletoe infection was encountered in the Goat Creek Area, growth losses may be significant, especially in Douglas-fir. In addition, severely infected hosts are particularly susceptible to other pests such as bark beetles and root diseases. The effects of dwarf mistletoes can be significant, especially if infected trees overtop susceptible understories for many years. Infected shelterwood or seed trees should be removed before susceptible regeneration reaches a height of 3 feet or an age of 10 years to prevent the small trees from becoming infected. Control can be easily achieved during normal silvicultural operations.

Other pests--Both the Douglas-fir beetles and the fir engraver beetles occurred infrequently and were not primary tree-killers. They were usually associated with trees affected by root diseases or other stresses. Brown cubical rot was observed primarily on older trees affected by other pests, often laminated root rot. Although some wood loss to decay can be expected, the disease does not warrant major concern. White pine blister rust, caused by the fungus *Cronartium ribicola*, was observed killing young (less than 10 years old) western white pine trees wherever the species occurred in the area. Because white pine is tolerant to laminated root rot, it is often considered for planting in diseased areas. The frequent occurrence of blister rust suggests a high hazard site, but the area should be hazard-rated for blister rust to determine if the use of resistant planting stock is necessary. Additional information pertaining to hazard-rating sites for blister rust is available from Forest Pest Management personnel.

MANAGEMENT RECOMMENDATIONS

Since most of the Goat Creek Area is infected by *P. weirii* and because of the open nature of the stand, it may be extremely difficult to delineate infected areas. Instead, we suggest arranging as many harvest units as possible, preferably in areas of concentrated mortality, and removing all Douglas-fir and subalpine fir. When clearcutting, remove all unmerchantable trees of these species, including advanced regeneration. When selective cutting, retain ponderosa pine and lodgepole pine as first choices and Engelmann spruce as a second choice for seed and crop trees whenever possible. Douglas-fir and subalpine fir should not be planted. We recommend planting, either singly or in mixture, ponderosa pine, lodgepole pine, western white pine, or Engelmann spruce, wherever they are adapted to the site. Subsequent thinning operations in the plantations should discriminate against Douglas-fir and subalpine fir. During commercial thinning operations, do not thin within 50 feet of an infection center. In all likelihood, a mixed-species stand will result from natural regeneration of Douglas-fir and subalpine fir between planted pine and spruce. However, the rate of root disease spread and subsequent damage should be reduced because of the discontinuity of susceptible root systems in the future stand.

We recommend removing as many dwarf mistletoe-infected trees as possible during harvesting operations. If mistletoe-infected seed trees or shelterwood trees must be retained, remove them before susceptible regeneration is 3 feet tall or 10 years old, whichever occurs first. Remove all mistletoe-infected trees along the margins of clearcuts to prevent spread to the new stand. Additional guidelines for dwarf mistletoe suppression and sanitation can be found in the FSM 3480. Contact Forest Pest Management about the availability of funds for dwarf mistletoe control.

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